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Effect of bright-light therapy on depression and anxiety of a patient with Alzheimer's disease combined with sleep disorder

Mei X *et al.* Effect of BLT on AD

Xi Mei, Chen-Jun Zou, Cheng-Ying Zheng, Jun Hu, Dong-Sheng Zhou

Abstract

BACKGROUND

Alzheimer's disease (AD) is a common type of dementia due to neuronal impairment. In addition, psychobehavioral symptoms including severe sleep disorders, depression and anxiety can occur in most patients with AD.

CASE SUMMARY

We report a case of a 68-year-old woman with a 2-year history of AD. She initially presented with memory loss, progressively more severe, leading to a depressive and anxious status. The clinical symptoms also included severe sleep disturbances. Considering the age and health state of the patient, a non-pharmacological treatment of bright light therapy was used to improve her sleep quality. The treatment was provided for 30 minutes twice a day, during 8: 30 am to 9: 00 am and 16: 30 pm to 17: 00 pm. After 4 weeks of therapy, the sleep quality notably improved, with a marked decrease in daytime sleep, increase in nighttime sleep, and disappearance of nocturnal activity. The depression and anxiety were also suppressed significantly.

CONCLUSION

This case report suggested that bright light therapy can have a positive effect on sleep quality in elderly patients with AD and can be used as an effective and safe non-pharmacological treatment.

Key Words: Bright-light therapy; Sleep disturbance; Alzheimer's disease; Dementia; Non-pharmacological treatment

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Core Tip: This report describes the case of a patient who developed Alzheimer's disease, accompanied by sleep disorders, depression and anxiety; we provided bright-light therapy to improve her sleep quality. bright-light therapy can reduce the duration of daily sleep and nighttime restlessness, with a higher efficacy than medications in improving sleep.

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INTRODUCTION

Alzheimer's disease (AD) is a neurodegenerative disorder with various clinical manifestations, including cognitive decline, mental and behavioral alterations, and sleep disturbances[1]. The bidirectional relationship between AD and sleep disorders has been investigated extensively; sleep disturbances are a risk factor for AD and also a consequence of this disease[2]. A growing body of literature has examined sleep quality and cognitive function in elderly patients with AD[3]. Sleep disturbances exacerbate systemic inflammation and increase β -amyloid ($A\beta$) accumulation; β -amyloid a one of the major factors in AD pathogenesis[4]. Therefore, improving of sleep quality might have beneficial effect in AD. The cognitive decline cannot be completely eliminated; however, reducing sleep disturbances could prolong the cognitive abilities of patients with AD[5]. Multiple pharmacological and non-pharmacological approaches have been

proposed for clinical treatment[6]. Bright-light therapy (BLT) is a non-pharmacological method usually adopted in elderly patients with sleep disorders[7,8]. Previous studies have shown that BLT can reduce depression and improve sleep quality in patients with mild cognitive impairment and neurodegenerative diseases[9-11]. Therefore, BLT is increasingly recommended as a first-line treatment for sleep disorders in patients with dementia, considering also its safety and efficacy[12]. This report describes the case of a patient who developed AD, accompanied by sleep disorders, depression and anxiety; we provided BLT to improve her sleep quality. BLT can reduce the duration of daily sleep and nighttime restlessness, with a higher efficacy than medications in improving sleep.

CASE PRESENTATION

Chief complaints

A 68-year-old woman presented with progressive memory loss, cognitive decline, and symptoms of dementia.

History of present illness

In the month before admission, she started having poor nighttime sleep quality or insomnia and being active in her room at night, heavily affecting her family's rest, and was accompanied to our hospital for treatment.

History of past illness

The patient's illness began 2 years prior, initially with short-term memory loss and incoherent speech. Later, the symptoms gradually worsened, and the patient started forgetting what she said immediately before, being unable to return home after a walk, and requiring assistance by the police and supervision from her family in daily life. She frequently believed her family stole her possessions and became depressed, irritable, and suspicious, often reprimanding her family members without reason.

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Personal and family history

The patient denied any family history of AD.

Physical examination

At the initial consultation, the patient was conscious and cooperative in conversation; however, she could not recall immediate events or what she ate for her last meal and was not aware of being in the hospital. She was poorly oriented in time and space and towards other persons, with reduced volitional activity and lack of self-awareness.

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Laboratory examinations

Blood counts, ultrasensitive C-reactive protein, and biochemistry were unremarkable.

Imaging examinations

A head computed tomography scan showed evident cerebral atrophy and no other organic lesions or cerebral infarct foci (Figure 1). No other somatic diseases possibly causing mental disorders were noted, and she had no history of hypertension, diabetes mellitus, or stroke.

FINAL DIAGNOSIS

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The patient was diagnosed using the Diagnostic and Statistical Manual of Mental Disorders, fifth edition criteria[13]. The patient was diagnosed with AD by two research psychiatrists and provision of informed consent. The cognitive level was evaluated by mini-mental state examination (MMSE) score < 17, 20, and 24 in patient with education levels of illiteracy, primary school, and junior high school, respectively[14]. The disease course was more than 3 months. Donepezil or memantine was used to improve the cognitive level. The patient has no history of other severe mental illnesses. The MMSE of the patient score was 17. Based on these findings, the patient was diagnosed with Alzheimer's disease accompanied by psycho-behavioral symptoms and was subsequently hospitalized.

TREATMENT

BLT protocol

The phototherapy equipment (Figure 2) was designed by the Geriatrics Center of the Ningbo Kangning Hospital as described in our previous study[15]. It was mounted on a portable cart, and the intensity of the light source was adjustable from 0 to 20000 lux. The treatment was provided for 30 minutes twice a day, during 8: 30 am to 9: 00 am and 16: 30 pm to 17: 00 pm. The patient was seated 0.5-1 m from the light source; the light intensity provided was 14000 lux, for a 4-week course of treatment. The patient faced the light source and sited in a comfortable chair. After that, the nurse secures the portable cart and turns the light to patient, and reminds the patient that he or she is ready to begin treatment. During the course of treatment, patient was asked to remain quiet and not to get up and walk around. The patient was administered memantine oral solution 7.5 mL/q.m. and carboplatin capsules 3 mg/b.i.d., for intellectual stimulation, and olanzapine tablets 5 mg/day. for antipsychotic treatment. Moreover, she underwent light therapy to improve the poor nighttime sleep quality.

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OUTCOME AND FOLLOW-UP

After 4 weeks of hospitalization, the cognitive level was stable (MMSE 18), whereas the psychiatric symptoms decreased, and the family reported improved mood and disappearance of paranoia. The patient's sleep quality markedly improved, with notable decrease in daytime sleep, increase in nighttime sleep, and absence of nocturnal activity.

DISCUSSION

We presented a case of severe AD complicated with sleep disturbances, treated with BLT. Sleep problems are common in patients with AD and place a high burden on their caregivers. Several medications can be used to increase sleep duration and improve its quality; however, the risk of side effects can also increase. Non-pharmacological

treatment could be useful to avoid the risk of using multiple drugs in elderly patients with comorbidities. BLT can help regulate the sleep-wake cycle in older adults with dementia[16]. In a previous study, BLT was suggested to supplement daylight as a trigger for the suprachiasmatic nucleus (SCN)[17]. It can be used at any time during the day to promote wakefulness and reduce daytime sleep, realigning the patients' circadian rhythm to the typical sleep timings[18]. In this study, we provided BLT after breakfast and after dinner to maintain the wakeful state in the patient. There is a 4-hour interval between the time of BLT after dinner and the time of going to sleep at night, so it does not affect the patient's sleep. Additionally, an adequate sleep duration and circadian rhythm have a beneficial effect on the gut microbiota and digestive function[19].

Moreover, BLT is a well-established method to improve mood in seasonal affective disorder[20], and the effect of BLT on patients with non-seasonal depression has also been examined in a large number of clinical trials, as reported in a review[21]. In this case, the patient presented with depressive symptoms; with BLT, these symptoms markedly improved, though the cognitive dysfunction remained stable. The BLT mechanism of action has been investigated in previous studies; intrinsically photosensitive retinal ganglion cells project to the SCN and mediate the effects of light on learning. Mood regulation by light, on the other hand, requires an SCN-independent pathway linking intrinsically photosensitive retinal ganglion cells to a previously unrecognized thalamic region, named perihabenular nucleus[22]. The SCN can also be stimulated by BLT to enhance spatial memory[23]. BLT is known to improve nighttime sleep. A quality night's sleep can be rejuvenating and enhance the patient's ability to concentration during the daytime. Although BLT was reported to enhance spatial memory, whether it can improve memory to recall immediate events and become more oriented in time and space for those with reduced volitional activity and lack of self-awareness need to be studied in future.

BLT can also have positive effects on delirium and sundowning syndrome[24]. Circadian-related disorders and alterations in sleep-wake patterns are common

complaints in elderly individuals, especially those diagnosed with AD[25]. Light is the main stimulus of the circadian melatonergic system; therefore, patients with AD should be encouraged to walk outdoors in natural light. The strength and limitation of BLT: Although very few patients reported transient side effects including headaches and eyestrain during the course of the BLT, it was still an effectiveness non-invasive therapy for clinical application. Comparing to medication, BLT is suitable for patients with comorbid conditions, such as hypertension, diabetes mellitus, or a history of stroke, and reduces the physical burden of drug interactions on older adults with multiple health issues. Combined pharmacological and non-pharmacological measures could be adopted in elderly patients before considering multiple pharmacological measures.

CONCLUSION

This case report suggested that BLT can have a positive effect on sleep quality in elderly patients with AD and can be used as an effective and safe non-pharmacological treatment.

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